THESIS/REPORT
HALL, TROY E.

CHANGES IN WILDNERNESS CONDITIONS RESULTING FROM IMPLEMENTATION OF A DESIGNATED-SITE CAMPING POLICY

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Changes in Wilderness Campsite Conditions Resulting from Implementation of A Designated-Site Camping Policy

Troy E. Hall

Department of Forestry

Virginia Tech

Blacksburg, VA 24061

540 231-7264

tehall@vt.edu

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Introduction

This report describes changes on campsites in Mount Jefferson and Three Sisters Wildernesses that occurred after implementation of a designated-site camping policy at several lakes in 1995. Research supported by the Aldo Leopold Wilderness Research Institute also included conducting interviews with campers to understand whether and how site conditions affected site choice, and to what extent visitors' ratings of conditions correlated with measurements. Those data have been reported in two articles (White et al. 2001; Farrell et al. in press) and are not discussed in this report.

For the study reported here, initial data, collected between 1987 and 1992 (depending on the destination area) were compared with data collected in 1999 using multi-parameter assessment methods. Information was collected at Green, North Matthieu, and South Matthieu Lakes in Three Sisters Wilderness and at Duffy and Square Lakes in Mount Jefferson Wilderness, on approximately 100 campsites. Initially we had hoped to study sites at Jefferson Park as well, but late snow prevented access there.

Research on site impacts has determined that dispersal policies often lead to a proliferation of sites and therefore overall impacts (Cole & Ranz 1983; Cole 1993). Lightly-used sites often deteriorate rapidly with small increases in use, whereas heavily-used sites may reach a more stable, albeit substantial, level of impact (Cole & Hall 1992; Marion & Cole 1996). Because of this relationship between use and impact, one current recommendation is to concentrate use in high-use areas on a smaller number of sites (Leung & Marion 1999). This may lead to the development of several heavily-impacted sites, but should reduce aggregate impacts across the landscape. Such policies are relatively new, and therefore have not been well-

evaluated. A rigorous assessment requires data about site conditions obtained before and after a use concentration strategy is implemented, and such information is not typically available.

One study by Marion (1994) suggested that a designated site camping policy along the Delaware River resulted in substantial reductions in overall impact. However, it is not clear how well those results generalize to other environments (e.g., western mountains versus low-elevation eastern riparian areas). Marion and Cole (1996) reported higher vegetative resilience at Delaware Water Gap than typically observed in western wildernesses. Apart from the Delaware Water Gap research, few efforts have been made to document changes resulting from use concentration strategies.

Therefore, this study was designed to determine: 1) whether and how much designated campsites deteriorate after designation; 2) whether and how much previously legal sites now closed to camping improve after closure to camping; 3) whether new sites develop outside the regulation boundary (see below); and 4) whether and how much total destination impacts change.

Methods

Study Area

In the wildernesses studied here, earlier campsite assessments had identified a large number of sites at several lakes (Hall & Shelby 1993). Information on site usage indicated that the number was well in excess of what was needed to accommodate existing use levels. For example, although more than 30 sites had been identified at Duffy Lake, rangers never observed more than 10 groups camping there at one time. Therefore, a policy requiring camping at designated sites, with tents to be erected within 15 feet of a post, was implemented at several lakes in 1995. Policies differed somewhat among the lakes. At some lakes, visitors who desired

to camp within 250 feet of the lakeshore were required to camp at a designated site, but those who were willing to go beyond the 250-foot boundary could select any spot to camp. This policy was intended to minimize aggregate impacts while retaining some degree of freedom for those who might seek it. At Green and South Matthieu Lakes, on the other hand, the designated-site camping policy was in effect within ¼ mile of the shoreline. Additionally, campfires were prohibited at Green Lakes; this policy was in place before the initial 1992 campsite assessment. At Duffy Lake, when the designated site policy went into effect, campfires were permitted only at certain sites. Table 1 displays the characteristics of the study lakes and regulations in place during 1999, and Table 2 presents information about the number of sites assessed. Some sites were not inventoried at one or the other time, because of time constraints or other conditions (e.g., snow drifts).

Table 1. Characteristics of Study Lakes and Regulations in Place in 1999

Lake	Elevation	Dominant Overstory	Campfires Permitted?	Camping boundary[a]
Green	6400 ft.	Mt. Hemlock, Whitebark pine	No	¼ mile
Duffy	4800 ft	Mt. Hemlock, Lodgepole pine	At selected sites	250 ft.
Square	4800 ft	White fir, Mt. Hemlock	At selected sites	250 ft.
North Matthieu	5800 ft	Mt. Hemlock, Subalpine fir	Yes	250 ft.
South Matthieu	6000 ft.	Mt. Hemlock, Subalpine fir	Not within ¼ mile	250 ft.

[a]Designated site camping enforced within this distance of lakeshore.

Table 2. Number of Sites Observed and Assessed at Study Lakes

	Initial Assessment			1999		
Lake	Year of first assessment	Total Sites Present	Sites Assessed	Total Sites Present	Sites Assessed	Number of Designated Sites
Green	1990	37	32	44	36	28
Duffy	1987	34	33	31	30	13
Square	1991	12	12	16	15	6
North Matthieu	1994	29	25	27	23	7
South Matthieu	1992	7	6	9	9	3

Site Assessment Methods

Several parameters were evaluated at each site. In the earlier inventories, different personnel conducted evaluations at the different lakes (which are located on two National Forests and four Ranger Districts), and the same information was not always collected in each year. However, some level of consistency was probably achieved by having joint training in inventory methods at the beginning of each field season. In 1999, all sites were evaluated by the same three field researchers, with consistent data collected at each. The data form and detailed instructions are included as Appendices A and B. The parameters measured in 1999 and the methods used are described briefly below.

Inventory information: Site number, date of inventory, evaluator's name.

Status: Whether site is legal or closed to camping.

Location information: Distance from trail, water, and other sites.

Frequency of use: Researchers used their best judgment and characteristics of the site (including condition of the litter layer, fire ring, and overall appearance) to judge how often each site was used. Categories were: regularly, often, occasionally, infrequently, or never.

Vegetation cover: Average cover of live, non-woody plants across the impacted area was estimated using the following cover classes: 0-5%, 6-25%, 26-50%, 51-75%, 76-100%. The same assessment was made in a nearby, unimpacted control area. Vegetation loss was computed as the number of cover-classes difference between the control and the site. (E.g., a site with vegetation class 1 on-site and class 4 off-site would receive a rating of 3 for vegetation loss.)

Mineral soil exposure: The proportion of the site surface on which mineral soil had been exposed was estimated for the site and control area, using the same cover classes that were used for vegetation. Mineral soil increase was calculated as the number of cover classes difference between site and control.

Camp area: The area with any discernable impacts to vegetation was identified and sketched. Researchers paced off dimensions, including any satellite areas, but excluding islands of undisturbed vegetation.

Barren core area: Within the campsite boundary, researchers paced off the dimensions of the denuded core (defined as the area with less than 1% vegetation cover).

To ensure consistency among evaluators, two days of field training occurred at the beginning of the study. During that time, the two field researchers worked together to evaluate sites, under the supervision of the principal investigator.

Results

Number of Sites

Presenting changes in the number and condition of sites across time requires a classification scheme for sites, because some pre-existing sites disappear, while new sites appear. Thus, the total number of sites is not constant over time. In this case, during the interim between assessments, 10 sites disappeared, but 16 new sites appeared, mostly as the result of management actions. Table 3 displays the number of sites inventoried at each lake and their status as of the 1999 inventory. (Numbers are slightly lower than in Table 2, because sites for which either year of data were missing have been eliminated.) Pre-existing sites were classified as "gone" (no sign of the site in 1999), "illegal" or "closed" (previously legal, but made off-limits by the camping regulation), "legal-designated," and "legal non-designated" (outside the regulation boundary). All sites classified as "gone" would have been illegal in 1999, that is, they were within the regulation boundary and not designated for camping. New sites appeared in each of the three last categories.

As a result of the camping regulations, 59 pre-existing and 2 new sites were off-limits to camping (Table 4). The 10 sites that disappeared entirely were in this group. Thirty-six of the pre-existing sites were designated for camping, and 13 additional new sites were created by managers as designated sites. Most of these new sites were at Green Lakes. Only five pre-existing sites were classified as legal for camping, but outside the designated camping perimeter ("legal non-designated"). Only one new site of this type developed between the initial inventory and 1999. In addition to the 13 new designated sites, two new illegal sites developed. Thus, the total number of sites changed only slightly, from 100 at the time of initial assessment to 106 in 1999. This suggests significant success in preventing site proliferation in these areas. We had

been concerned that the regulation would push campers back away from the lake, where they would develop new sites. This did not happen.

Table 3. Number of Sites and Their Status, 1999

	Status						
	Closed in 1999			Open in 1999			
Lake	Gone	Illegal		Legal – D		Legal - ND	
	Number of Sites						
	Old[a]	New	Old	New	Old	New	Old
Green	3	0	10	10	12	0	0
Duffy	5	2	14	0	12	0	1
Square	0	0	8	2	3	0	1
N. Matthieu	2	0	13	0	7	0	3
S. Matthieu	0	0	4	1	2	1	0
Total	10	2	49	13	36	1	5
Total	10	51		49		6	
Total Present 1999	0	51		55			

[a] "Old" = present at time of initial inventory; "New" = new as of 1999 inventory.

Table 4. Classification of Sites, All Lakes Combined

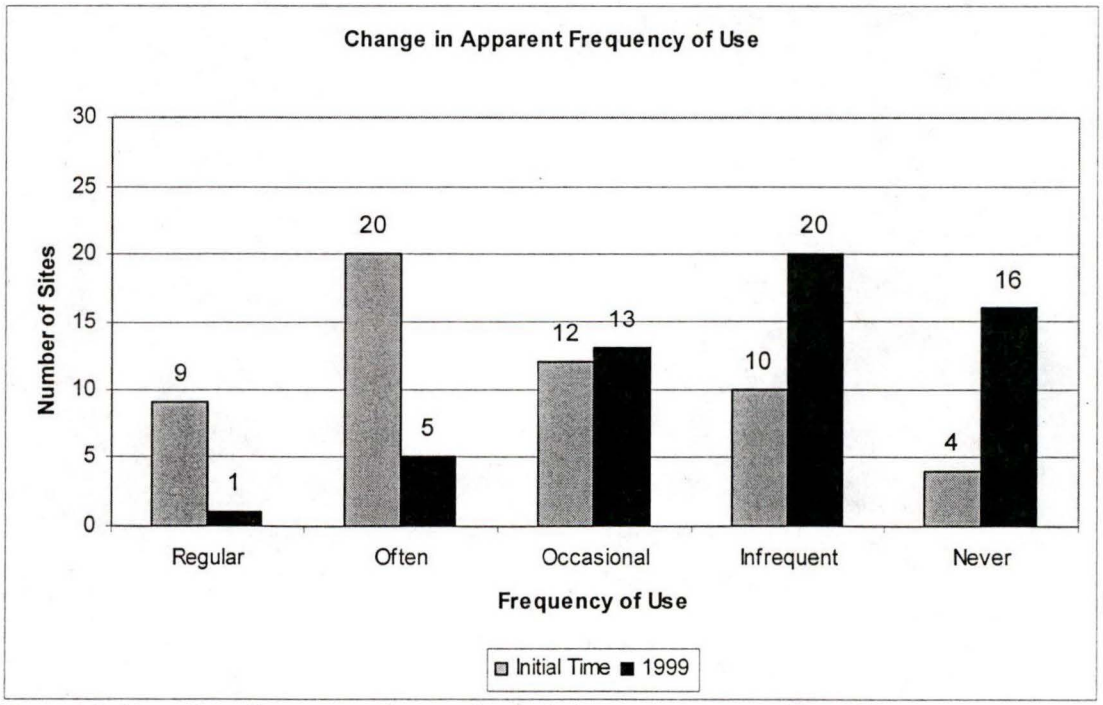
	Closed to Camping	Legal Designated	Legal Non-Designated	Total
	Number of Sites			
New in 1999	2	13[a]	1	16
Pre-existing, still in evidence	49	36	5	90
Gone in 1999	10	0	0	10
Total	61	49	6	

[a] Created by managers

Apparent Use of Sites

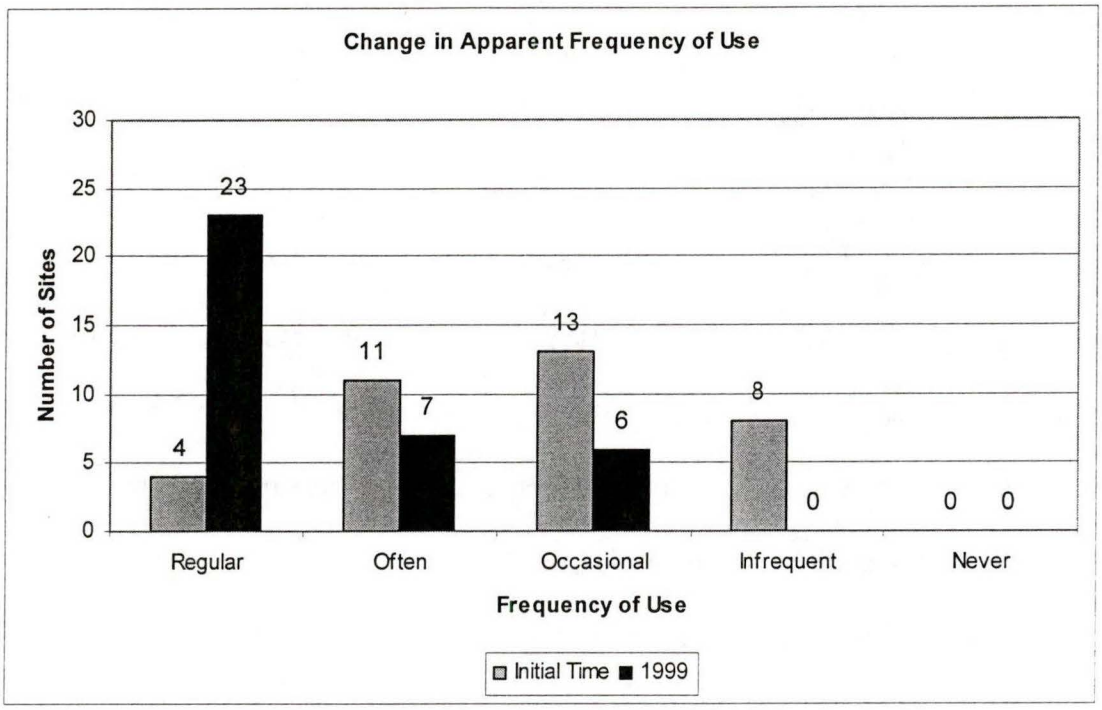
During the initial assessments, relatively few (n=13) sites appeared to receive regular use, whereas the majority (n=58) were used occasionally or often (Figures 1 to 3). By 1999, use had shifted, so that 27 sites appeared to receive regular use and 44 appeared to be infrequently or never used. As anticipated, the sites receiving less use tended to be those closed by the new regulations – 65% of the sites in this category in 1999 were judged as being used infrequently or never (Figure 1). On the other hand, 64% of the legal designated sites were judged as receiving regular use (Figure 2). Although these data are based on researchers' impressions of use, rather than accurate data about use levels, they appear consistent with managers' expectations and desired changes.

Figure 1. Change in Apparent Frequency of Use on Closed Sites



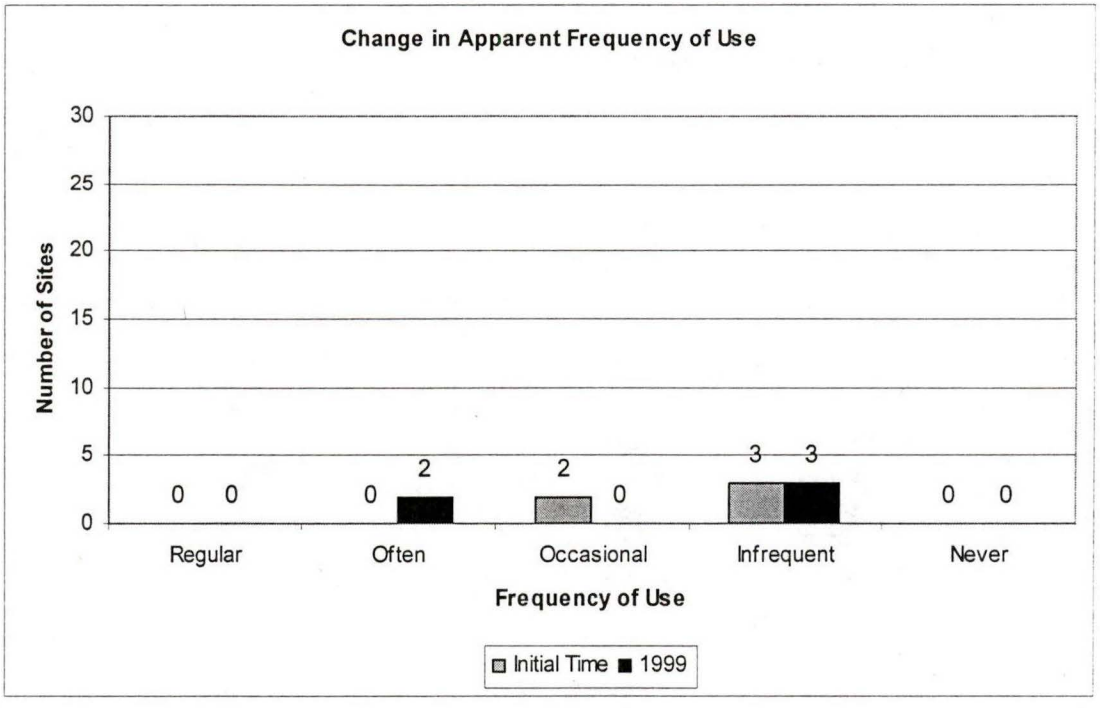
Note: 10 Sites that disappeared were included as "never" used in 1999.

Figure 2. Change in Apparent Frequency of Use on Legal Designated Campsites



Note: New sites not included. (See Figure 4)

Figure 3. Change in Apparent Frequency of Use on Legal, Non-designated Sites



Note: New sites not included. (See Figure 4)

Interestingly, the new sites (almost all of them designated sites created by managers) were varied in use – whereas 8 received infrequent or occasional use, 8 others received use regularly or often (Figure 4). This variation may be because some of the designated sites were very difficult to find or a long distance from the closest trail access.

Figure 4. Apparent Frequency of Use of New Sites, 1999

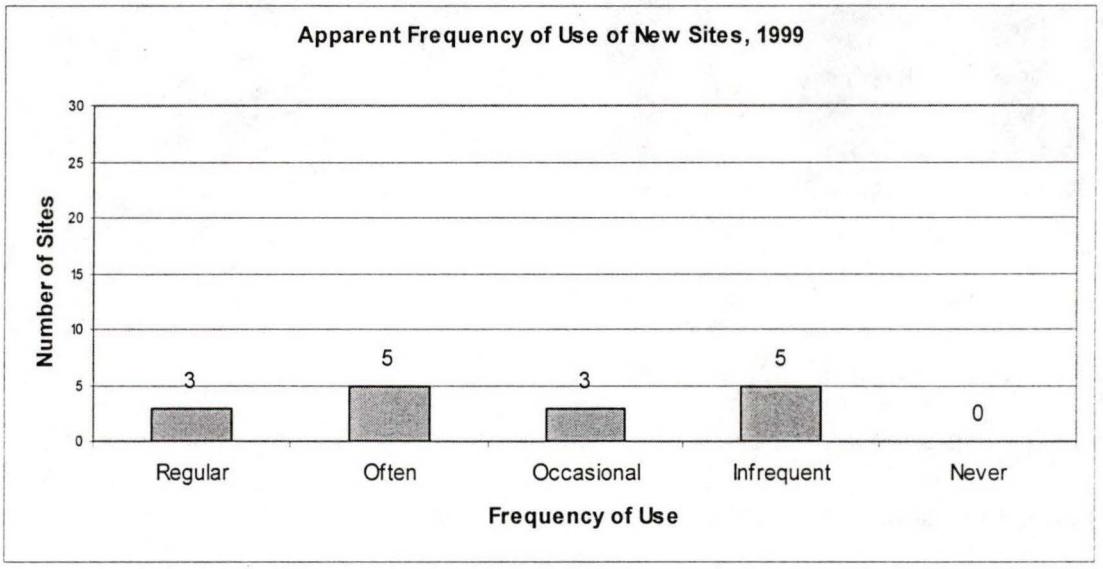
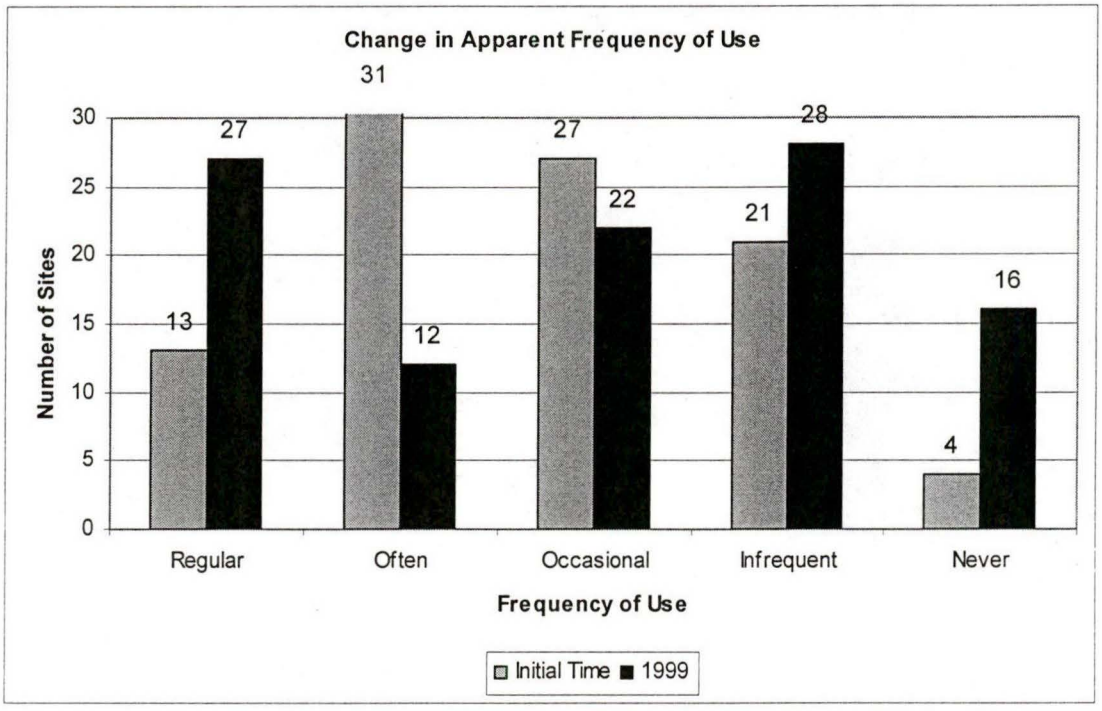


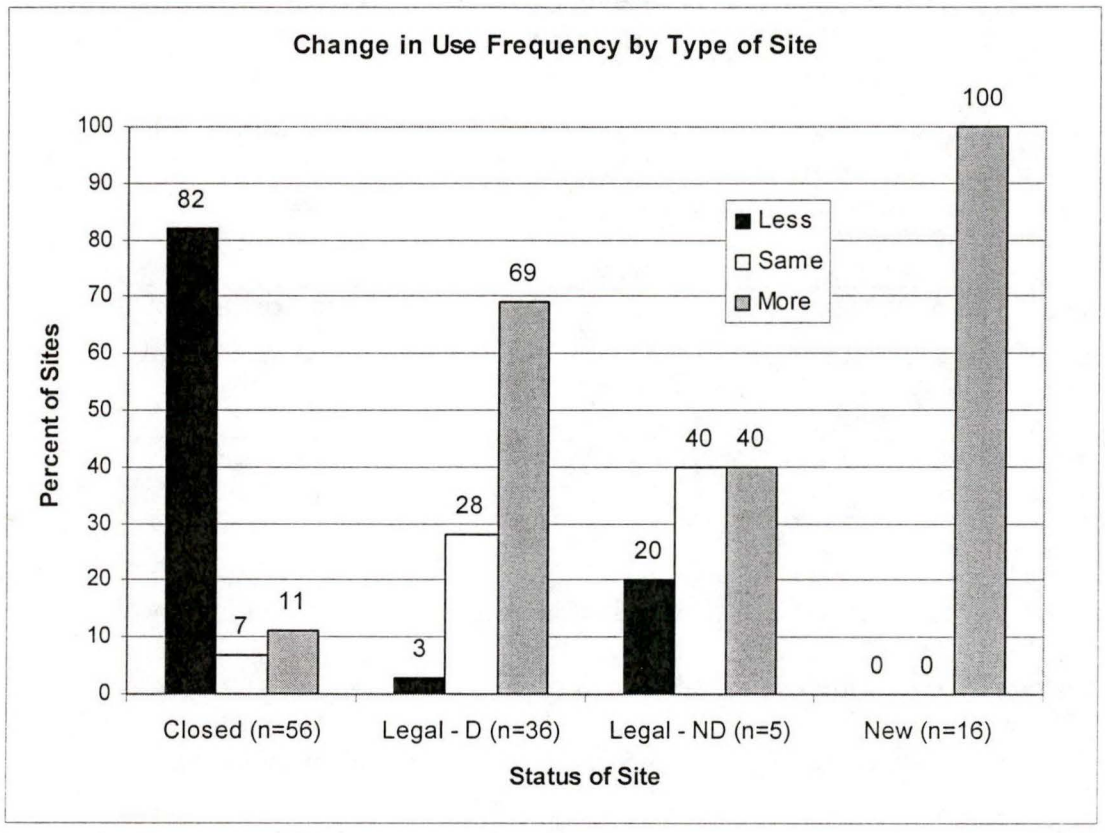
Figure 5. Change in Apparent Frequency of Use, All Campsites



Looking at all sites together, the designated site regulation appeared to change a more normal distribution of use during the initial inventory to a more bimodal distribution in 1999 (Figure 5). That is, in 1999, fewer sites were used often or occasionally, but more were used regularly or infrequently.

Another way to explore these data is on a site-by-site basis, asking whether an individual site was used more frequently in 1999 than at the earlier time. Looking at the data this way, closed sites (which include the 10 sites that disappeared) generally showed signs of being used less in 1999 than at the time of the earlier inventory (Figure 6). However, almost 20% appeared to be still receiving at least as much use as previously. In some cases, this was because the closed sites were located directly on a path between a designated site and the water, or in an area used by day-hikers, and therefore still sustained on-going impacts. Almost 70% of pre-existing legal, designated sites were receiving more use in 1999 than before.

Figure 6. Change in Use Frequency by Type of Site



Vegetation Impacts

Examination of the amount of vegetation cover on campsites indicates some changes over time (Table 5). Among the sites made off-limits to camping ("closed"), the majority had about the same amount of vegetation as previously. However, 16 closed sites showed improvements, 7 enough to disappear. Interestingly, 8 of the pre-existing legal designated sites showed increases in vegetation, while 10 pre-existing sites showed the expected decrease in vegetation over time. However, even four years after their establishment as designated sites, and despite increased use, 18 designated sites had the same vegetation cover as before designation.

Table 5. Change in On-Site Vegetation Cover

	Amount of On-site Vegetation Compared to Amount at Time of First Assessment		
Classification	More	Same	Less
	---------- *Number of Sites* ----------		
Illegal/Closed	9 pre-existing 7 gone	29 pre-existing 2 gone	8 pre-existing
Legal, Designated	8 pre-existing	18 pre-existing	10 pre-existing
Legal, Non-Designated	0 pre-existing	3 pre-existing	2 pre-existing
All sites	24 pre-existing	52 pre-existing	20 pre-existing

Looking at on-site cover alone, as depicted in Table 5, does not account for any changes that may have occurred more widely in the surrounding environment as a result of weather or other factors. Nor does it depict the degree of on-site change relative to controls or the magnitude of change over time. Thus, it is useful to examine relative vegetation loss as well as on-site cover. Tables 6 and 7 show the relationship between initial condition and condition in 1999, expressed as the degree of difference between on-site and off-site vegetation. (That is, "0" in column and row headers in the tables indicates no difference in cover class between site and control, whereas "4" indicates a difference of 4 cover classes; i.e., 76-100% cover off-site and 0-5% cover on-site.) Relative loss at the initial time is displayed across columns, while relative loss in 1999 is displayed down rows. Cells contain the number of sites for each combination of conditions. Sites falling below the diagonal had worsened compared to controls, while those above the diagonal had improved. Sites on the diagonal showed no change.

Whereas Table 5 suggested that about half of the sites were stable, with the rest split between those that improved and those that deteriorated, Tables 6 and 7 give a different impression. Table 6 shows that on closed sites (those still present in 1999 and those that had

disappeared), relatively little improvement occurred, when one takes into account surrounding vegetation changes. Although 22 of 57 (39%) sites were stable in relative loss, only 10 (18%) improved. In 1999, 24 closed sites had 3 or 4 cover classes less vegetation on-site than on their controls, compared to only 10 at the time of the initial inventories. On legal, designated sites (including the 13 newly created by managers), only 10 of 49 (20%) were stable, while the majority (69%) deteriorated (Table 7).

Table 6. Comparison of Initial Vegetation Loss to 1999 Vegetation Loss on Closed Sites (Number of Sites)

		Pre-Existing Condition – Vegetation Cover Class Difference Between Site and Control					
		0	1	2	3	4	Total
1999– Vegetation Cover Class Difference Between Site and Control	0	4	7	1			12
	1		4	1			5
	2	3	5	8			16
	3		3	8	5	1	17
	4	0	1	2	3	1	7
	Total	7	20	20	8	2	57

Note: Includes 10 sites that disappeared.

Table 7. Comparison of Initial Vegetation Loss to 1999 Vegetation Loss on Legal Designated Sites (Number of Sites)

		Pre-Existing Condition – Vegetation Cover Class Difference Between Site and Control					
		0	1	2	3	4	Total
1999– Vegetation Cover Class Difference Between Site and Control	0	1					1
	1	9	3	1			13
	2	6	5	4	3	1	19
	3	3	3	4	2		12
	4		1		3		4
	Total	19	12	9	8	1	49

Note: Includes 13 new sites.

Much of the deterioration in vegetation cover on legal designated sites occurred on those that initially had relatively little vegetation loss (Table 7), as might have been expected. However, the consistent tendency toward greater vegetation loss over time across all sites was not expected. The discrepancy between the impressions created in Table 5 (stability) and Tables 6 and 7 (deterioration) deserves further attention. An examination of the data indicates that off-site controls were evaluated as having more vegetation in 1999 than in earlier years (Table 8). Thus, even though several sites had more on-site vegetation in 1999 than previously, the difference between sites and controls tended to increase over time. It is possible that conducting evaluations early in the summer of a particularly wet year generated more dense forb cover in the surrounding areas in 1999. The sites themselves, many of which simply had no vegetation, may not have been able to respond to increased moisture with as great an increase in cover. Because of these changes on control sites over time, it may be most useful to compare tendencies across all closed versus all open sites, rather than examining absolute changes on individual sites. In

this context, 23 of 56 closed sites (41%) deteriorated (in terms of relative vegetation loss), compared to 34 of 49 legal sites (69%).

Table 8. Changes in Vegetation Cover on Controls between Time of Initial Assessment and 1999

	More	Same	Less
	----------Number of Sites ----------		
Closed[a]	25	17	5
Legal Designated (not including new sites)	21	11	4
Legal Non-Designated (not including new sites)	4	1	0
All Sites	50	29	9

[a] Does not include 10 that disappeared. Information on controls for those sites was not collected in 1999.

Soil Impacts

A substantial number (37%) of closed sites and about half of the pre-existing legal, designated sites showed improvements in mineral soil exposure on site (Table 9). Additionally, many of the sites classified as having the "same" amount of mineral soil exposure in 1999 had no soil exposure to begin with and were therefore in good condition. The stability or improvement across all sites is notable. Mineral soil conditions respond more rapidly to site closures, especially in forested areas, than do vegetation conditions, so the improvement is not surprising. Mineral soil conditions are also more sensitive to the season in which the assessment is done, because needle litter accumulates over the winter and is present at the beginning of the use season. The assessment in 1999 was done shortly after snowmelt, which may account for some of the apparent improvement in soil conditions.

Table 9. Change in Mineral Soil Exposure by Category of Site

Classification	Better	Same	Worse
	----------*Number of Sites* ----------		
Closed	20 pre-existing 2 gone	21 pre-existing 8 gone	9 pre-existing
Legal, Designated	17 pre-existing	10 pre-existing	7 pre-existing
Legal, Non-designated	2 pre-existing	3 pre-existing	0 pre-existing
All sites	30 pre-existing 2 new	34 pre-existing 8 new	16 pre-existing

When on-site soil exposure data are presented relative to off-site controls, expressed as the number of cover classes difference between site and control, 28 of 56 (50%) closed sites were the same in 1999 as previously in amount of mineral soil exposed compared to controls, while 16 (29%) had improved and 12 (21%) had deteriorated (Table 10). On legal, designated sites, 19 of 49 (39%) were stable, 12 (24%) improved, and 18 (37%) deteriorated (Table 11).

Table 10. Mineral Soil Increase on Closed Sites in 1999 Versus at Time of First Assessment (Number of Sites)

		Pre-Existing Condition – Mineral Soil Cover Class Difference Between Site and Control					
		0	1	2	3	4	Total
1999– Mineral Soil Cover Class Difference Between Site and Control	0	16	9	0	1		26
	1	8	8	3			19
	2		4	3	2	1	10
	3				1		1
	4					0	0
	Total	24	21	6	4	1	56

Table 11. Mineral Soil Increase on Legal Designated Sites in 1999 Versus at Time of First Assessment (Number of Sites)

		Pre-Existing Condition – Mineral Soil Cover Class Difference Between Site and Control					
		0	1	2	3	4	Total
1999– Mineral Soil Cover Class Difference Between Site and Control	0	15	6	2			23
	1	14	2	4			20
	2	3	0	1			4
	3	1			1		2
	4					0	0
	Total	33	8	7	1	0	49

Note: Includes 13 new sites.

Camp Area and Bare Core Area

Figures 7 to 12 display changes in total camp area and bare core areas for closed sites (Figures 7 and 8), legal designated sites (Figures 9 and 10), and legal non-designated sites (Figures 11 and 12). Diagonal lines represent sites with no changes; those falling below the line

deteriorated (grew larger) over time, while those above the line improved (became smaller). On closed sites, 27% got larger, while 67% shrank in total camp area. Improvements of large magnitude occurred on only a handful of sites, as might be expected in the type of environments included in this study. Unfortunately, however, several closed sites expanded considerably, despite being off-limits to camping. Some of these were areas at Duffy Lake that had previously been roped off as restoration areas. When the ropes were removed in 1995, traffic probably increased through them.

Change was less common in the bare core areas on closed sites – 24% were stable over time, 37% improved, and 39% deteriorated.

Legal designated sites did not grow substantially in total area (Figure 9). In fact, 43% were smaller in 1999 than before, though not by a large amount. Those that did grow (53%) did not grow dramatically, and almost half of these were sites that were created by managers (and thus by definition grew in size).

On the other hand, bare core areas did expand on legal designated sites (Figure 10). Only 15% (7 sites) had smaller bare core areas in 1999 and some had enlarged substantially. Several sites that had no bare core at the initial inventory, including those that were newly created by managers, had more than 1000 ft^2 of bare ground by 1999.

Although there were very few legal, non-designated sites, they appeared to expand in size over time (Figures 11 and 12), both in total area and in bare core area.

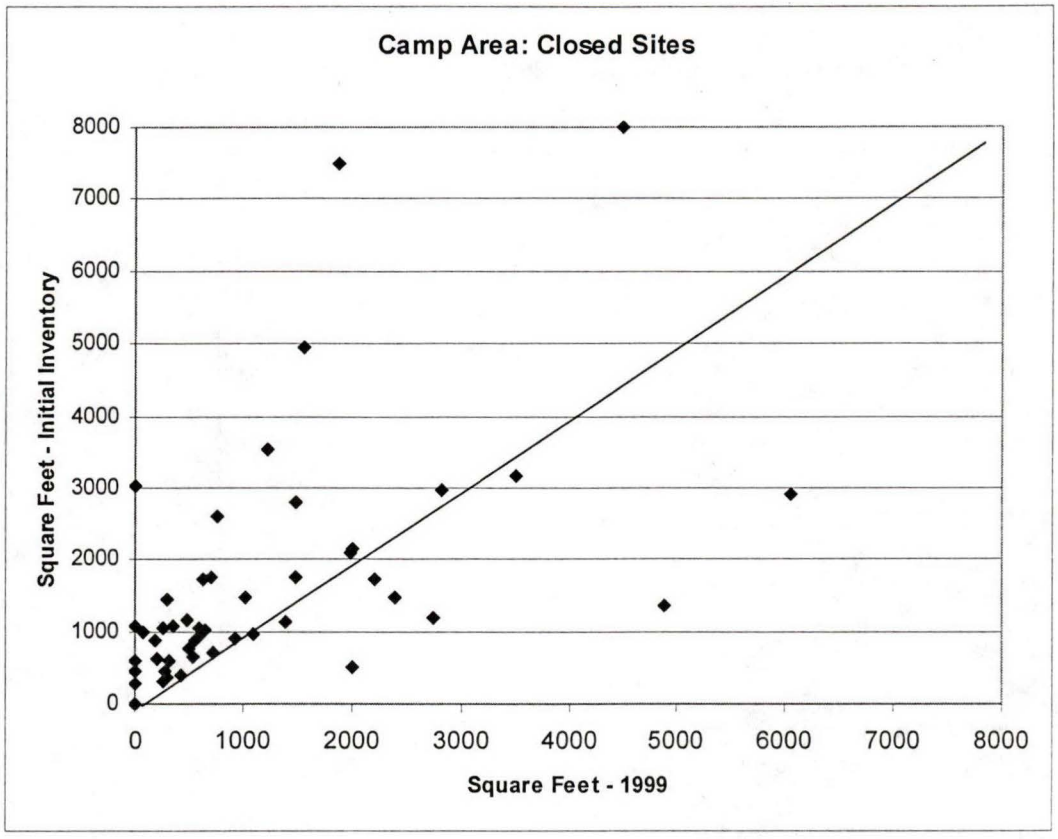


Figure 7. Camp Area in 1999 Versus at Time of Initial Assessment, Closed Sites

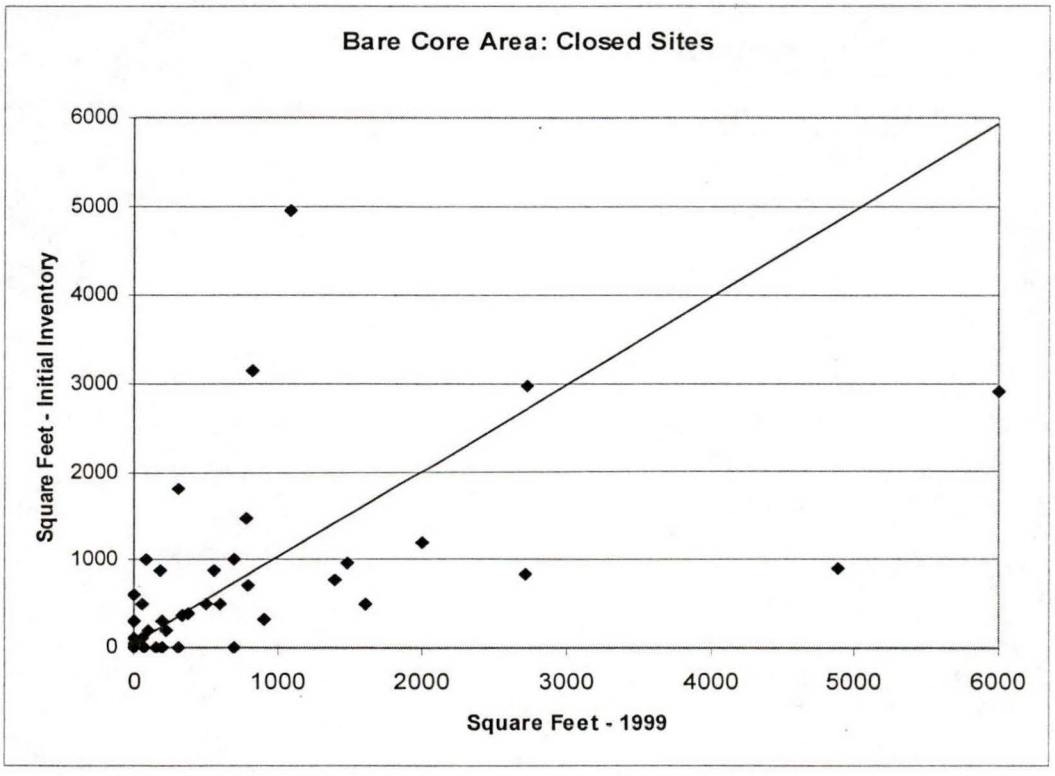


Figure 8. Camp Bare Core Area in 1999 Versus at Time of Initial Assessment, Closed Sites

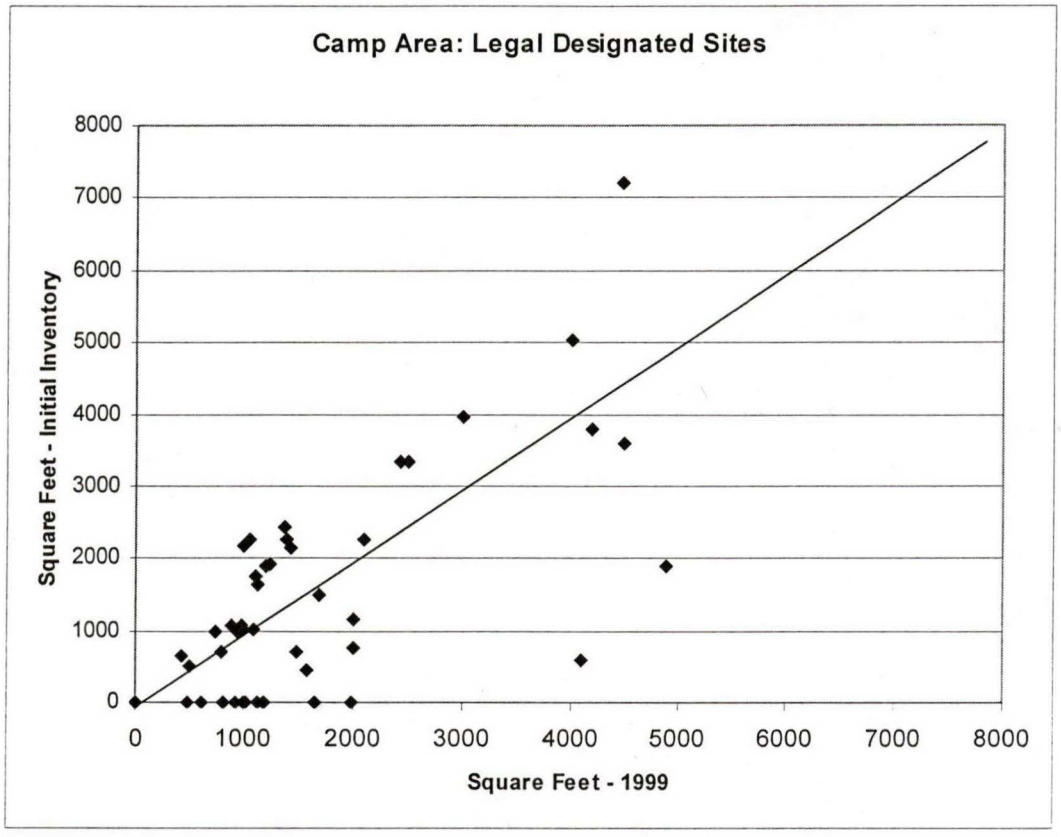


Figure 9. Camp Area in 1999 Versus at Time of Initial Assessment, Legal Designated Sites

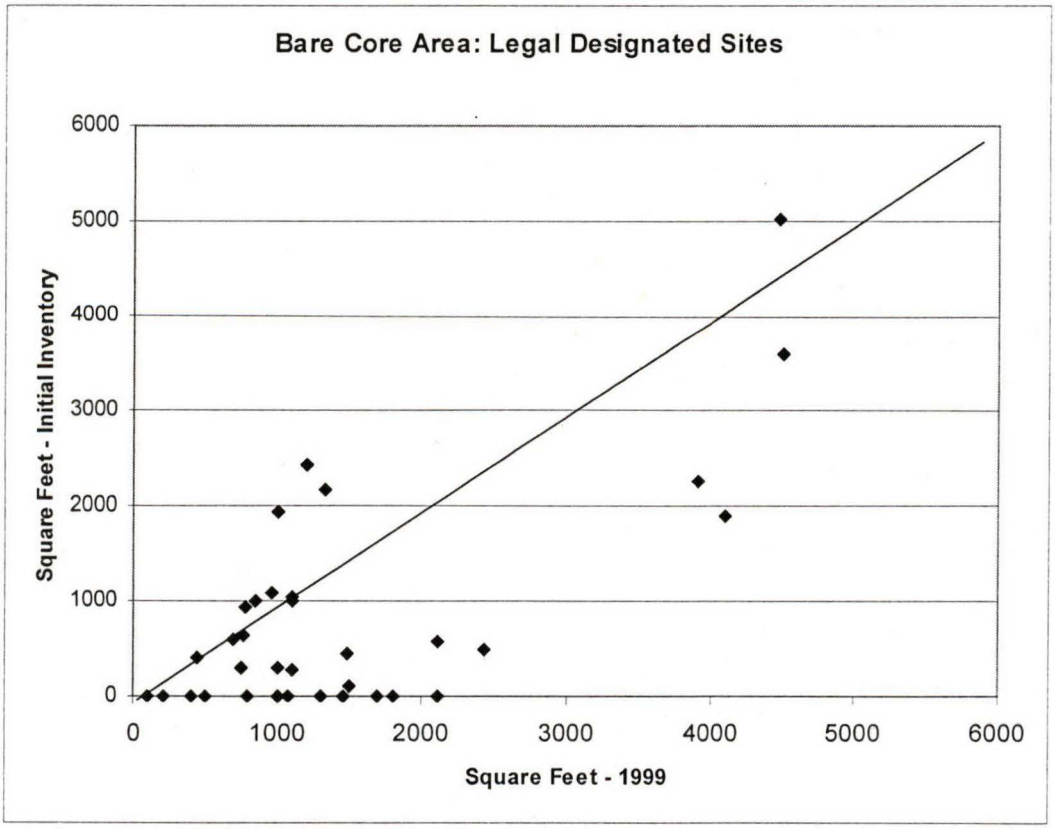


Figure 10. Camp Bare Core Area in 1999 Versus at Time of Initial Assessment, Legal Designated Sites

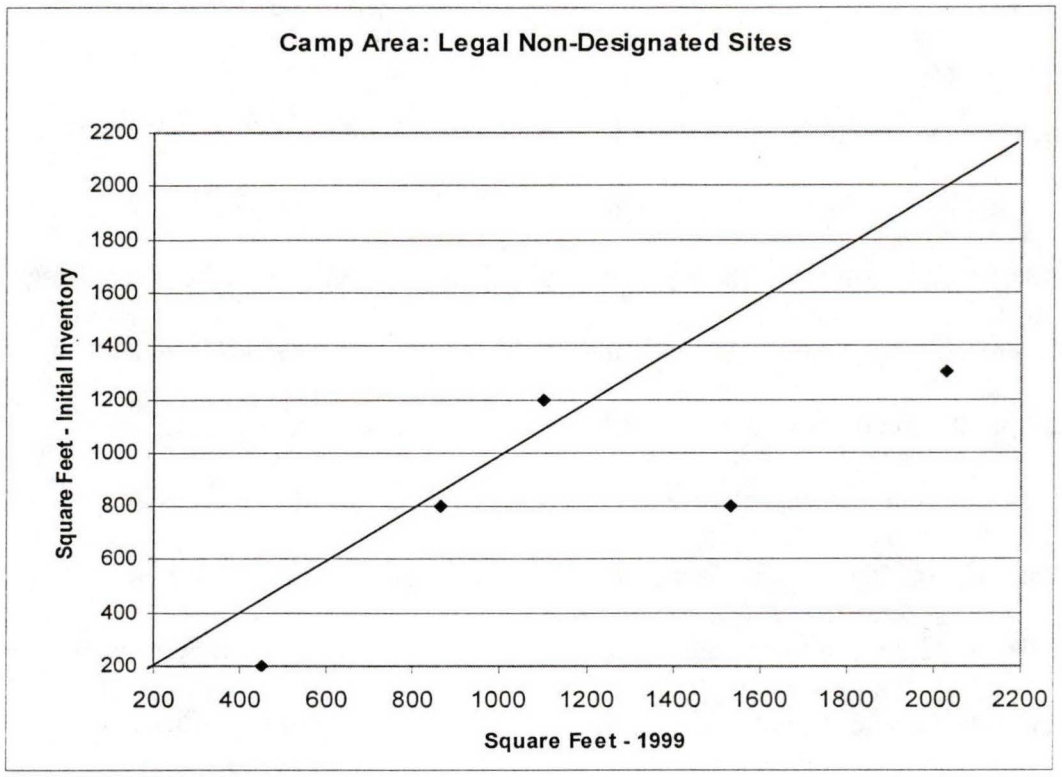


Figure 11. Camp Area in 1999 Versus at Time of Initial Assessment, Legal Non-Designated Sites

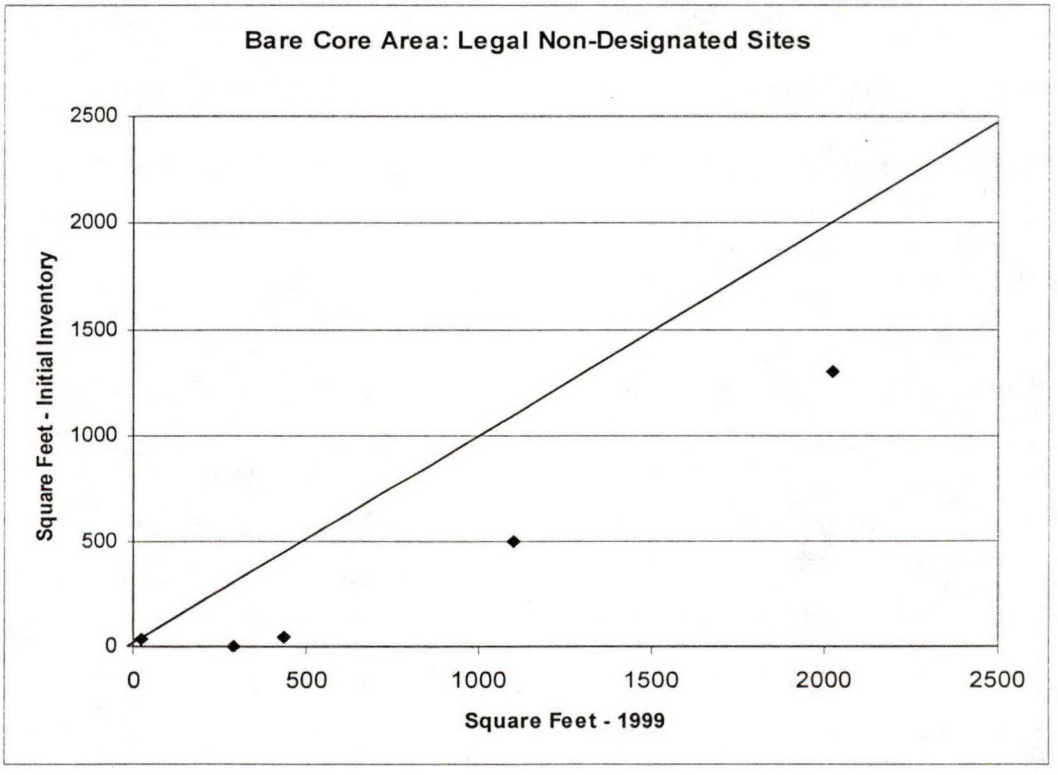


Figure 12. Camp Bare Core Area in 1999 Versus at Time of Initial Assessment, Legal Non-Designated Sites

Aggregate Impacts

The designated site camping policy adopted in Three Sisters and Mount Jefferson was intended to reduce the total amount of impact at several high-use destinations, following recommendations of current research. Therefore, it is an important question whether decreases in use on closed sites result in levels of improvement that offset increases in use on legal sites. To explore this question, this section examines available data for fire sites and total camp areas.

Table 12 displays cumulative conditions on sites in 1999 compared to the earlier inventories for campfire impacts (the number of fire rings and fire scars). The number of fire sites decreased markedly after implementation of the designated site camping policy. However, it is difficult to know whether the changes were entirely due to the camping policy or to other management actions. For example, at Green Lakes, fires were not permitted during either inventory period, but at Duffy Lake, fires were restricted to a few of the designated sites when that policy was adopted in 1995. Nevertheless, it appears that the majority of improvement occurred on the illegal sites, suggesting that the use-concentration strategy did indeed result in fewer fire sites across the landscape.

Table 12. Total Number of Fire Rings and Fire Scars Counted at Time of Initial Assessment and in 1999

	Fire Rings		Fire Scars	
Category of Site	Initial Time	1999	Initial Time	1999
Gone	7	0	1	0
Illegal	40	9	36	22
Legal Designated	35	24	27	22
Legal, Non-designated	5	3	6	4
Total	87	31	70	48

Table 13 displays information about total camp area and bare core area. Although, by definition, improvement occurred on the sites that disappeared, taken together these sites made up a relatively small percentage of the overall impacted area, especially of the bare core area. A small reduction (17%) in total camp area occurred on illegal sites, but the total bare core area actually increased slightly (7%) across all illegal sites. On the other hand, the legal designated sites showed a moderate (26%) increase in total camp area, and a dramatic (114%) increase in bare core area. Thus, across all sites taken together, there was virtually no improvement in total camp area, and a substantial deterioration (51% increase) in bare core areas occurred.

Table 13. Aggregate Area of Impacts at Time of Initial Assessment and in 1999

	Camp Area (ft^2)		Bare Core Area (ft^2)	
Category of Site	Initial Time	1999	Initial Time	1999
Gone	5436	0	332	0
Illegal	77667	64208	42199	45166
Legal Designated	66025	83080	28489	60973
Legal, Non-designated	4300	6223	1876	4006
Total	153428	153511	72896	110145

Discussion

Almost no site proliferation occurred between the time of initial assessments and 1999 as a result of visitor activities. Some of these destinations had formerly been experiencing proliferation, and the designated camping policy implemented in 1995 appears to have halted this

process. The fear that visitors might want to go outside the regulation boundary and would thereby create new sites appeared unwarranted. One possible reason for the success is visitors' attraction to water. Apparently few campers desired freedom of choice sufficiently greatly to be willing to camp more than 250 feet from waters. Perhaps, because enough sites were designated to accommodate all users, and because designated sites typically were selected to have desirable features, most users were content with the existing sites. Alternatively, it is possible that at some of these lakes, most or all of the desirable camping locations had already sustained camping impacts, so that proliferation was unlikely to occur.

In contrast to the positive findings about site proliferation, findings pertaining to individual and aggregate site conditions were not so encouraging. Little improvement in vegetation loss and soil exposure occurred on closed sites, and substantial increases in vegetation loss relative to controls occurred for legal designated sites (Table 14). Although 64% of closed sites and 56% of legal sites actually became smaller in camp area over time, growth of some sites and the creation of new sites by managers led to no net change in overall camp areas. Bare core areas expanded considerably on designated sites, and even on 44% of closed sites.

Table 14. Percent of Sites That Were Stable, Improved, or Deteriorated, by Type of Impact and Category of Site

		Stable	Improved	Deteriorated
Relative Vegetation Loss	Closed	39	16	44
	Legal Designated	20	10	69
Relative Soil Increase	Closed	50	29	21
	Legal Designated	39	24	37
Camp Area[a]	Closed	11	64	24
	Legal Designated	8	56	35
Bare Core Area[a]	Closed	14	42	44
	Legal Designated	3	21	76

[a]New sites not included. "Improved" and "deteriorated" indicate >5% change from initial time.

It would not have been surprising to find that closed sites were relatively stable or showed modest improvements in resilient types of conditions like mineral soil exposure. The deterioration on many of these sites was therefore somewhat unexpected. It appears likely that, in these areas where up to 80% of use is by day users and where closed campsites are located along travel routes or shorelines, enough use of some sort is still occurring to maintain or even exacerbate impacts. Closed sites were not identified or barricaded, so there were few deterrents to travel through them. Day users, or campers from other sites, pass through or even rest in these closed shoreline sites.

Trends on designated sites suggest that these sites are generally stable in terms of total camp areas, which are rather large on average. It is encouraging that few dramatic increases in individual camp areas occurred (apart from those on managerially created sites). However, bare core areas expanded and may continue to do so. Such deterioration occurs more rapidly than site recovery, and we may expect to find some short-term increases in overall impact over the next few years. It is unknown how long bare core areas will continue to grow, or whether they will reach stable maximum sizes that are acceptable to managers and visitors.

Overall, the data reported here suggest rather limited success associated with requiring visitors to camp at designated sites. Of course, it is possible that conducting an evaluation after only four years since implementation, especially in these high elevation areas, gave insufficient time for effects to be noticeable. Therefore, another evaluation should probably be conducted after a few more seasons have passed. Additionally, the lack of recovery on certain sites, especially those on travel ways or lakeshores, highlights the need for managers to conduct an overall site assessment to understand the geographic patterns of visitor use, before selecting sites for camping and closure.

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APPENDIX 2: 1999 Campsite Condition Data Collection Form and Instructions

1. DATE:_____ 2. SITE NUMBER_____3. STATUS: ___ legal/D ___ legal ND ___ illegal

4. EVALUATOR: _____ 5. MGT AREA _____

6. VEG (circle one)
1 – closed forest 3 – nonforested, dense veg
2 – open forest 4 – nonforested, sparse veg

Dominant Spp._____

7. DIST TO SYSTEM TRAIL _____ft.
screening: 1 – complete 2 - partial 3 – none

8. DIST TO NON-SYSTEM TRAIL _____ft
Type: 1 – user trail 2 – abandoned trail

9. DIST. TO WATER _____ (ft. from edge of site)

10. DIST. TO CLOSEST CAMPSITE _____ ft. to # _____

11. TYPE OF USE: (circle all that apply)
1 – foot 3 – river 5 – hunter 7 – other
2 – stock 4 – outfitter 6 – day

12. FREQUENCY OF USE: (best guess)
1 – regularly 3 – occasionally 5 – never
2 – often 4 – infrequently

13. CLOSEST FIREWOOD SOURCE: (circle one)
1 – on-site 3 – 100-300 ft. 5 – > ¼ mile
2 – < 100 ft. 4 – 300 ft – ¼ mi.

14. FACILITIES: (write number of each in blank):
____ fire ring ____ nails ____ primitive seat
____ other _____ _____

Cover classes for vegetation and soils: 1 – 0-5% 2- 6-25% 3 – 26-50% 4 – 51-75% 5 – 76-100%

	1999 Evaluation		Previous evaluation	
15. VEGETATION COVER: (compare similar areas, same spp, slope, rockiness, canopy cover)	On-site	Unused comparative area	Onsite	Offsite
	_____	_____	_____	_____

Comments: _____

16. MINERAL SOIL EXPOSURE: (Percent of area that is bare mineral soil)

	_____	_____	_____	_____

Comments: _____

17. TREE DAMAGE:	scarred:	_____	_____
	felled:	_____	_____
18. ROOT EXPOSURE	# trees	_____	_____
19. CLEANLINESS:	fire scars	_____	_____
	litter	_____	_____
	manure	_____	_____
20. CAMP AREA:	Dimensions	_____ x _____	_____ x _____
	Sq. ft.	_____	_____

Comments: _____

21. BARE CORE AREA:	Dimensions	_____ x _____	_____ x _____
	Sq. ft.	_____	_____

Comments: _____

22. SOCIAL TRAILS	Number:	_____	_____
23. # SITES WITHIN SIGHT OR SOUND		_____	_____

Certainty of match with previous evaluation: ___ the same site ___ probably the same site

___ probably not the same site ____ definitely not the same site

Identifying characteristics of site: _____

_____

_____

_____

Use Trends: _____

_____

Attractive or unattractive features of site: _____

_____

_____

Apparent management interventions _____

_____

_____

_____

Other comments: _____

_____

_____

_____

_____

Photo Number: Roll _____ Frame _____

Map: (indicate photopoint, fire rings, major trees, other sites, trails, water, other features)

Instructions

Date:	Date of evaluation
Site Number:	USFS managerial code. Match to map provided
Status:	"legal/D" = legal, designated site (has a post); "legal ND" = legal site but outside of the designated camping setback, so no post present. Usually >200' from water; "illegal" = closed to camping by designated camping requirement. Sites closed to camping for other reasons (eg, restoration) should be so noted.
Evaluator:	Evaluator's name
Mgt Area:	Wilderness and lake/destination
Vegetation Type:	Record the general physiognomic classification of the site. "Closed forest" is used where canopy closure is >= 50% over the entire site. "Open forest" is used where canopy closure is <50% over the entire site. "Non-forested dense vegetation" is used for sites with no trees, but where the natural cover of forbs and shrubs is at least 50% of the ground surface (when projected vertically). "Non-forest sparse vegetation" is used for sites where the natural forb and shrub cover is less than 50%. Record the dominant tree, shrub, and forb species present.
Dist. to System Trail:	Straight-line distance (feet) from the edge of the site to the closest edge of constructed system trail. Record amount of screening: Complete – no part of the site is visible from the trail; Partial – some parts of the site are visible from the trail; None – no part of the site is visible from the system trail. * Be sure that if measures in previous years were from the center of the site, you also record distance from center of site.
Dist Non-System Trail:	In some cases, especially around lakes, sites will be located adjacent to well-established user trails, but far from developed system trails. Measure the straight-line distance (feet) from main user trail or abandoned trail. * Be sure that if measures in previous years were from the center of the site, you also record distance from center of site.
Dist. To Water:	Measure distance (feet) from edge of site to closest water. * Be sure that if measures in previous years were from the center of the site, you also record distance from center of site.
Dist. To Closest Site:	Measure distance from edge of the site to the edge of the nearest other site. Evaluate screening from the center of the site, not from the edge. Complete screening implies that no part of another site is at all visible; no screening means that an entire camp is visible from the center of the site. Partial screening is any case in between.
Type of Use:	Most of the sites receive foot and/or stock use. However, it is important to note whether a site appears to receive day use.
Freq. Of Use:	Give your best estimate of frequency of use. Regular use = every weekend; Often = 2 weekends a month in summer; occasional = 1 weekend every month or two; infrequent = once a summer; never = hasn't been used in last couple of years.

Closest Firewood: Record how far a camper would have to walk from the center of the site to be able to collect a large armload of wood that is larger than 1' in diameter but small enough not to need an axe (not twigs or large logs).

Facilities: Record the number of each type of development. Include logs and rocks to sit on as primitive seats. Include tent pads as developments if they have been dug into the ground or trenched.

Vegetation Cover: Estimate the understory (forbs and low shrubs) cover (Daubenmire cover classes) across the site. Often the core of the camp is entirely denuded, whereas vegetation persists around the edges of the site. If vegetation is not evenly distributed, mentally divide the site into regions of homogenous vegetation and make estimates for each region. Then compute the site average by computing the weighted average across all regions of the site. The estimate should be an average for the entire area considered within the boundaries of the site.

For off-site vegetation, choose an area that is similar in slope, soil, tree cover (species and canopy), distance to water, and other characteristics as the campsite. Estimate the understory cover for that control area. (You are attempting to estimate what the original cover of the site was prior to human use.)

Mineral Soil Exposure: Mineral soil consists of soil layers beneath the surface humus, which are low in organic content. Estimating mineral soil exposure can be difficult – under the canopy of spruce and mountain hemlock, organic duff layers can be quite thick, even when no understory vegetation is present.

Estimate on-site and control-site mineral soil exposure in the same classes as vegetation. Be sure to note (comment line) if there are problematic judgment calls required for estimating soil exposure.

Tree Damage: Record the number of trees with human caused mutilations (typically axe marks) and the number of cut stumps on the site and in the surrounding area. Do not count as damage small nails or carvings on naturally downed logs. If possible, distinguish between the number of damaged trees on site (actually within the campsite boundaries) and the number of damaged trees in the surrounding area.

* If the original inventory distinguished between "badly" and "slightly" scarred, make note of each type. Badly damaged trees have damage to their cambium or damage that causes the tree to alter its growth or die. Slight damage includes spikes in trees, small hatchet marks, and things attached to trees.

Root Exposure: Record the number of trees with roots exposed by human trampling or by livestock within the site and in the surrounding area. (This is the number of trees, not the number of roots.) Note on the back of the inventory form (or on the map) whether these are on site or outside the camp area. (For example, you will count "horse donuts" that are located outside the campsite boundaries.)

Cleanliness: Record the number of fire scars (additional to any fire rings recorded under developments).

Camp Area: The camp area is defined as that area where any discernable impacts to vegetation occur. Determine the size by pacing the dimensions of appropriate geometric shapes. Be sure to include any satellite tent pats or any stock holding areas, measured

separately and added to the main camp area. Also draw a sketch map indicating these areas.

Bare Core Area: The barren core of the campsite is that area completely devoid of vegetation (i.e., less than 1% cover). Measure this area by pacing (as for camp area). Lightly impacted sites may have no barren core, whereas on heavily impacted sites the entire camp area may be barren core.

Social Trails: Count the number of visitor-created trails that radiate from the camp area. Some of these may be quite short. If a trail runs through a camp (i.e., in one side and out another) count it as two trails.

Certainty of match: Based on photos and data from the previous inventories, indicate your level of certainty that this is the same site previously evaluated.

Identifying chars: What are the nearby geographical features? How far are they? In what direction?
Is the site on a slope or flat ground?
Are there downed logs through the site or around it?

Use trends: Is the site always used? Never? Is it impossible to tell?
Has there been recent use?
Do people walk through the site to get to attractions or water?

Attractive features: What makes the site attractive to users? To managers?
Is the area resistant to impacts (or especially susceptible)?
Is there an especially nice view?

Apparent mgt interv.: What evidence is there of active management of this site over the past few years? (Examples include revegetation, signing, removal of firerings)

Other comments: Did you have difficulty assigning ratings for any parameters? (Not sure about degree of vegetation loss or soil exposure? Root exposure could be natural?)
Are felled trees in site or outside? Are they small or large? Have snags been chopped?
Was it difficult to determine the site boundaries, or are the boundaries obvious? What shape is the site?
Is there a distinctive barren core, or none at all?
Is soil compaction a problem? Erosion? Is there a heavy duff layer?
If this site is part of a cluster of sites, how did you determine which site was which?

Photo info:

Map:

General Instructions:

1. In previous years, the rapid inventories assessed all impacts within the site boundaries proper and also within the immediately surrounding area. If damage (eg litter or tree damage) was attributed to one site, it was not attributed to another. If such impacts occur between sites, assign them to the closest site.